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UNDERSTANDING ARSON THROUGH COMMUNITY RESILIENCE

by

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A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Arts
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in the College of Sciences
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ABSTRACT

Over 40,000 arsons were reported in the 2014 Uniform Crime Report; however, this number is underestimated since there are no official arson trends reported by the FBI due to the lack of agencies reporting this offense. Arson is one of the most destructive and under researched crimes. This lack of research can be attributed to the dual definition of arson – that is, the destruction of one’s own property or someone else’s property – the opportunistic nature of arson, and the inability to determine a measurable rate. The current study uses data from the Chicago Police Department’s Citizen Law Enforcement Analysis and Reporting (CLEAR) System and the 2010 American Community Survey 5-Year Estimates to explore arson offending among and across neighborhoods within the framework of routine activities theory and social disorganization theory. Spatially weighted negative binomial regression is used to test correlation and significance. Analyses were run in STATA and ArcGIS 10.4.1. Results are consistent with prior arson research showing that rates of occurrence are increased by structural measures such as social disorganization, physical disorder, and public transportation. However, racial heterogeneity and accessibility to public transportation are shown to both increase or decrease rates of arson occurrence depending on the subtype of arson. These results suggest that community characteristics may play a greater role in understanding arson offending than previously thought.

Keywords: arson, community resilience, Chicago, routine activities theory, social disorganization

I dedicate this writing to the victims of these offenses and to the first responders who responded to these scenes, many of whom lost their lives or have been severely injured. Structures can be rebuilt, but lives cannot be replaced.

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CHAPTER ONE: INTRODUCTION

“Arson – the most neglected crime on Earth” – R. E. May, 1974

Arson is defined as “any willful or malicious burning or attempting to burn, with or without intent to defraud, a dwelling house, public building, motor vehicle or aircraft, personal property of another, etc.” (Federal Bureau of Investigation, 2016). Arson offenses are one of the most destructive crimes in the United States. According to the United States Fire Administration, intentionally set fires resulted in \$613 million in property loss and 157 civilian casualties in 2015 (State of Illinois Office of the Fire Marshal, 2015). In the State of Illinois, 1025 fires were investigated; 357 were incendiary and 528 were listed as undetermined or under investigation in 2015. The total estimated property loss was \$508 million (State of Illinois Office of the Fire Marshal, 2015). According to the 2014 Uniform Crime Report, there were 40,000 arsons reported by agencies; however, this number is underestimated. Due to the lack of reporting at the state and federal levels, there are no official arson trends reported by the Federal Bureau of Investigation (FBI, 2016). Despite the overwhelming damages resulting from arson, arson investigation has been plagued by a mythology of arson (Lentini, 2006) and miscommunication regarding the responsibility of investigation (Pettiway, 1985). Due to these factors, there has been little academic research due to the inability to determine a valid rate and/or availability of valid data (Pettiway, 1985). Arson research has focused on arson clustering within low-income minority neighborhoods during the 1980s and 1990s (Pettiway, 1983; 1985; 1987) and the psychological profiling of offenders (Hurley & Monahan, 1969; Pettiway, 1987; Canter & Fritzon, 1998). Recently, arson research has begun to make a comeback (Grubb & Nobles, 2015;

Gerrell, 2016); however, this research focuses on understanding the recidivist rate of arson and the validity of arson research using larger units of analysis (e.g., census tracts). Despite this research, there has been no studies examining why a particular socially disorganized neighborhood is more at risk than another socially disorganized neighborhood. The goal of the proposed study is to understand arson offending among socially disorganized neighborhoods. I will do this by using a synthesis of Shaw and McKay's (1942) social disorganization theory and Cohen and Felson's (1979) routine activities theory to examine resiliency and vulnerability. Arson data is drawn from the City of Chicago Citizen Law Enforcement Analysis and Reporting system and socioeconomic data is drawn from the United States Census Bureau. Theory-driven variables, such as social disorganization and capable guardianship, will be operationalized in Chapter Three and will be discussed in relation to the spatially-weighted negative binomial regressions in Chapter Four.

Chapter Outline

This thesis is divided into five chapters including the introduction. In brief, Chapter 2 focuses on the theoretical framework and integration used in the current study, and the relevant literature in the fields of sociology, criminology, geography, and emergency management regarding arson offenses. Chapter 3 outlines the data and methodology that are used in the current study. Chapter 4 summarizes the results. Chapter 5 discusses the results and relates them to previous literature and proposes future directions for arson research.

CHAPTER TWO: LITERATURE REVIEW

Social Disorganization and Community Resilience

Social Disorganization

Since the early 1900s, sociologists and criminologists have studied structural and social neighborhood characteristics to explain criminal behavior. In 1925, Robert Park and Ernest Burgess proposed that social problems, such as criminal behavior, can be studied through the evolution of cities as they expand outward. Through studying this evolution, neighborhoods within a city can be classified on a spectrum of social organization/disorganization. This spectrum is illustrated by Elliot and Merrill (1934) whereby social disorganization is the inverse of social organization. According to Elliot and Merrill, social organization is defined as “the combination of all characteristics making up individuals’ personalities, including all of their attitudes and values, as well as the social institutions in which they acted and that interacted in complex interrelationships to make up the framework of human existence” (as cited in Huff Corzine & Corzine, 2014, 10). In other words, differences in personalities, attitudes and ideas come into conflict with each other and ultimately result in social disorganization (Huff-Corzine & Corzine, 2014). In 1942, Shaw and McKay proposed social disorganization theory to explain juvenile delinquency in Chicago. Essentially, Shaw and McKay argued that criminal events occur due to a breakdown in informal social controls at a macro level. Conversely, Elliot and Merrill focused on the broader applications of social disorganization to understand all social problems and included individual level measures, such as single mothers and divorcees. As a

result, an emphasis on the interaction between individuals and communities was introduced; however, this led many researchers to switch to individual level applications of social disorganization theory.

Social disorganization theory was revived in 1988 by Robert Bursik who argued that neighborhood social disorganization is the result of a neighborhood's inability to regulate the behavior of its residents. This regulation occurs through formal and informal social controls. According to Bursik and Grasmick (1993), there are three levels of controls for neighborhoods: personal control, parochial control, and public control. These levels of control are based on familial ties, ties between neighborhood residents and formal institutions, and ties between neighborhoods and formal social control institutions, respectively. This process of (un)regulation is explained by Robert Sampson (1987). Sampson states that informal social controls are weakened by neighborhood characteristics such as family disorganization, residential mobility, and structural density. These controls are directly impeded by weak social bonds, community attachment, anonymity, reduced surveillance and guardianship. Indirectly, poverty and racial composition were found to affect informal control. Neighborhoods that have these characteristics are less able to perform guardianship activities and to assume responsibility for the supervision of youth. As a result, deviance is tolerated and public norms of social control are not effective (Sampson, 1987, 109). Recently, social disorganization theory has been revised to include measures of collective efficacy and social capital (Sampson, Raudenbush & Earls, 1997; Bursik, 1999; Morenoff, Sampson & Raudenbush, 2001). Defined by Putnam (1993), social capital is "the features of social organization, such as networks, norms, and trust, that facilitate coordination and cooperation for mutual benefit" (36). According to Bursik (1999),

“neighborhoods bereft of social capital are less able to realize common values and maintain the informal social controls that foster safety” (Bursik, 1999 as cited in Morenoff et al, 2001, 519). Similarly, in 1997, Sampson et al., introduced the concept of collective efficacy. Collective efficacy can be defined as a neighborhood’s (in)ability to establish and maintain order throughout the area (Sampson et al. 1997). In other words, social capital is comprised of the features that facilitate coordination and cooperation among residents, and collective efficacy is the link of trust and cohesion to intervene in a given situation (neighborhood-level measure of informal social control). Hence, the inclusion of collective efficacy and social capital can be used to understand a neighborhood’s level of resilience against criminal behavior.

Community Resilience

Drawing from Egeland et al. (1993), Pfefferbaum et al. (2005) and Ahmed et al. (2004), community resilience can be defined as a process through which community members develop resources to take meaningful, deliberate, collective action to remedy the impact of a problem, including the ability to interpret the environment, intervene, and move on despite high-risk status, chronic stress, or following prolonged or severe trauma. These resources can be material, physical, socio-political, socio-cultural, and/or psychological. According to Sonn and Fisher (1998), “those who adapt positively to profound stress have protective attributes. These include person-centered factors such as perceived self-efficacy, temperament, and setting-centered factors, such as warm and caring relationships with caregivers, which act as moderators of stressors” (Cicchetti & Garmezy, 1993; Cowen, Wyman, Work & Iker, 1995, 458). However, these factors expand beyond individual-level processes to include community-level measures. Cottrell (1976) theorizes that a competent community provides opportunities and conditions that

enable groups to cope with their problems. However, oppressed and nondominant communities have been represented as lacking in competence and not having resilience (Elsass, 1992). As stated by Sonn and Fisher (1998), “these neighborhoods are considered to be disorganized, damaged, and unable to provide adequate social and psychological resources for their membership to cope with adversity (Rappaport, 1997) as the natural support systems that existed in these communities were removed through oppression” (459). However, it has been suggested by several researchers (Cottrell, 1976; Potts, 1993; Sonn, 1996; Ahmed et al., 2004) that while disadvantaged neighborhoods are considered high-risk environments which produce ill-health and social problems, they are capable of adapting in the face of prolonged adversity.

Recently criminologists (Anderson, 2000; Sampson, 2014) have focused the interaction between adverse social and structural environments to explain adaptability and resilience of disadvantaged neighborhoods. Two concepts from these studies are the code of the street and the enduring neighborhood effect. In his seminal book *Code of the Street: Decency, Violence, and the Moral Life of the Inner City*, Elijah Anderson discusses the concept of respect as a form of governing etiquette in which people learn to negotiate public spaces in the inner city (Anderson, 2000). Anderson’s work is an example of a socio-cultural and psychological form of resilience. Unlike Anderson’s research which focuses on a microlevel scale, Sampson takes a macrolevel longitudinal approach to understanding resilience. In *The Great American City: Chicago and the Enduring Neighborhood Effect*, Robert Sampson focuses on how meaningful places serve as protecting factors against violent or deviant behavior for disadvantaged Chicagoans despite the dangerous environment they live in. Sampson’s work focuses on the physical and socio-political

aspects of community resilience. Criminological research has primarily focused on the inherent and inextricable link between community resilience and crime prevention.

Community-based Crime Prevention

The beginnings of community-based crime prevention are found in the paradigm of environmental criminology, specifically, Cohen and Felson's routine activities theory (1979) and Wilson and Kelling's broken windows theory (1982). Though not a theory itself, environmental criminology is a widely recognized perspective of crime that concentrates on the places, spaces, and objects that facilitate or prevent a crime from occurring (Randa, 2014). Specifically, environmental criminology seeks to understand how the structural environment facilitates opportunities for crime to occur. This process can be conceptualized and analyzed through the environmental backcloth. Brantingham and Brantingham (1993) define the environmental backcloth as "the elements which surround and are part of an individual that may be influenced by or influence his or her criminal behavior. In other words, it explores how different individuals and categories of individuals seem to react or 'see' the surrounding physical environment and what they do with what they 'see' or what is done by others who 'see' them" (6-7). In other words, an offender searches for a suitable target, such as a vacant building or incapacitated individual, positioned in space and time in a good location and favorable situation. Previous research (Brantingham & Brantingham, 1993; Sacks, 1972) argues that this search is not random. Simply put, it is a process through which offenders analyze the environment for opportunities during their daily lives (i.e., routine activities).

Positioned within environmental criminology, routine activities theory, proposed by Cohen and Felson in 1979, argues that three elements must converge in space and time in order

for a crime to occur: a motivated offender, a suitable target, and the lack of a capable guardian.

The underlying premise of this theory is how the interaction between an individual and their environment provides an opportunity for offending and the probability for victimization.

According to Cornish and Clarke (1986), routine activities theory assumes that criminals possess some level of rationality because of the reasoning involved in the process of selecting a location.

Offenders search for suitable targets during their usual routine activity nodes (e.g., work, school) by analyzing the area for vulnerabilities (e.g., street accessibility, lack of lighting), while also

looking for environmental elements which allow them to remain undetected (e.g., distance from the closest police station, no closed circuit cameras) by others (Sacks, 1972). Thus, the backcloth

for studying criminal events should include social, cultural, legal, spatial, and temporal

dimensions explicitly including the physical infrastructure of buildings, roads, transit systems,

land usage, design and architecture, as well as the people located within that physical

infrastructure (Brantingham & Brantingham, 1993). These criminogenic factors in the backcloth

fall primarily into three categories: demographic/socioeconomic/cultural characteristics, physical

characteristics, and person-environmental characteristics (Moreto, Piza & Caplan, 2014). Each of

these categories can be used to build a theoretical model of arson offending.

Summary of Arson Research

In 1992, the National Fire Protection Association (NFPA) established Guideline #921 which created new protocols and standardized fire investigation procedures (NFPA, 2016).

According to Lentini (2006), “fire investigation involves the comparison of the investigator’s ‘expectations’ with his perception of the behavior of the fire. If those fires are not properly

‘calibrated’, the result will be numerous errors. What is surprising is that after three centuries of

scientific examination of fire, myths have been added rather than dispelled” (p. 20). The misinformation regarding arson investigation has not been recalled; however, most reputable training organizations have stopped teaching the myths. In his 2009 article, Lentini argues that while Guideline #921 is widely ill-received by the fire investigation community, it is the closest “standard of care” regarding fire investigation. With the exception of a handful of studies (McCutcheon, 2013; Grubb & Nobles, 2015; Gerrell, 2016), the majority of arson research was completed prior to the implementation of Guideline #921. Therefore, there is some uncertainty as to the reliability of the data and accuracy of the results.

Arson is considered to be both a property and violent criminal offense in previous studies (Pettiway, 1983; Pettiway, 1985). This has caused academic research on arson to primarily focus on individual psychological correlates, specifically profiling offenders (Bradford, 1982; Hurley & Monahan, 1929; Pettiway, 1987), rather than the structural correlates of arson. Generally, arson has been regarded as a manifestation of mental abnormality (Hurley & Monahan, 1969) and as a socioenvironmental manifestation of self-harm (Pettiway, 1987; Canter & Fritzon, 1998). There has been little research regarding the structural correlates of arson and even less research regarding vulnerable and/or risky areas associated with arson incidents (Pettiway, 1985; McCutcheon 2013; Grubb & Nobles, 2015). This lack of research can be partially attributed to the opportunistic nature of arson (Stahura & Hollinger, 1988) and the difficulty of determining a measureable rate of arson (Pettiway, 1985). Despite the opportunistic nature of arson and the lack of a valid rate of arson, previous research has found percent poverty, percent black, unemployment, and percent multifamily/affordable housing to have a multiplicative effect on arson (Stahura & Hollinger, 1988; Pettiway, 1983; Pettiway, 1985). Recent arson research has

largely focused on the structural environment rather than the social environment. Grubb & Nobles (2015) use epidemiological methods to model arson as a pathogen, whereas Gerrell (2016) focuses on the reliability of using aggregated social measures like socioeconomic status in the spatial modeling of arson due to the modifiable areal unit problem¹ (MAUP).

Several studies have connected arson to socioeconomic status (Chandler et. al, 1984; Pettiway, 1985; Pettiway, 1983; Southwick & Butler, 1985; Duncombe, 1991). These studies have argued that lethal arson is more likely to occur due to a lack of fire service and fire prevention measures due to older housing, high population rates, and the inability to afford fire protection. Studies examining the clustering of arson offenses has been restricted solely to urban ghetto and non-ghetto neighborhoods (Pettiway, 1985) and a few major metropolitan cities such as Los Angeles, California (Grubb & Nobles, 2015) and Chicago (McCutcheon, 2013). Previous attempts to study structural correlates of arson to determine a measurable rate have viewed elements of social disorganization – e.g., family dissolution and inadequate housing – as an indirect rate of arson but not as a direct correlate of arson events (Pettiway, 1985).

An Epidemiological Model of Arson

In 1986, Hemenway et al. put forth an epidemiological model of arson where the burning of one building in a neighborhood infects the surrounding buildings. This infection causes property values and returns from maintenance repairs to decrease thereby increasing the likelihood of fires and the rate of abandonment. These abandoned buildings, in turn, create

¹ The MAUP refers to the problem associated with aggregating social data to geographic boundaries. This consists of both scale effects (e.g., size of the areal unit) and aggregation effects (e.g., how those units are assembled). MAUP usually results in distorted distributions of the variable being examined (National Centre for Research Methods, 2017).

suitable targets for arsonists. Moreover, the market values in deteriorating neighborhoods fall faster than the face value of insurance policies creating incentive for owners to burn down their own buildings² as it is more profitable than selling or renting on the open market. The people in the area change – the richer, stable, less fire-prone tenants flee and the poor remain. The sense of community deteriorates from the increasing residential migration to the suburbs. Thus, the infection spreads rapidly with fire being both a symptom and cause of neighborhood deterioration. In other words, arson serves initially as an infection of the built environment creating suitable targets for future offenses and other types of criminal behavior (Grubb & Nobles, 2015).

Current Study

Several researchers (Cloward, 1959; Sampson et. al., 1987; McCutcheon, 2013) have argued that socially disorganized neighborhoods provide opportunities for crime to occur by increasing the number of motivated offenders, creating suitable targets, and failing to provide formal and informal capable guardianship. Kubrin and Weitzer (2003) offer the following explanation for this phenomena: “High crime rates exist... because limited opportunities make it difficult for residents to pursue conventional goals and because they [the residents] lack the willingness or capacity to prevent deviance” (379). Therefore, social disorganization theory explains how suitable targets and motivated offenders arise.

While social disorganization theory and routine activities theory serve as stand alone explanations of crime, I argue that the integration of these two theories increases the

² The burning of buildings for insurance fraud was prevalent throughout the 1960s and 1970s in the United States. This has largely been referred to as “arson culture” by the fire investigation community (May, 1974).

understanding of arson offenses within socially disorganized neighborhoods. The integration of these two theories is not new; the precedent for which was set by Grasmick and Bursik (1993). In the current study, demographic/socioeconomic, and cultural interactions can be viewed through Shaw and McKay's (1942) social disorganization theory whereas physical characteristics can be viewed through the environmental backcloth. Person-environmental characteristics can be viewed through Cohen and Felson's (1979) routine activities theory. The association between crime and socially disorganized neighborhoods has been well documented; however, there has been little to no research examining what makes one socially disorganized neighborhood more resilient against criminal behavior than others. The current study seeks to fill this gap by explaining what may make one neighborhood more resilient than another against arson offending.

CHAPTER THREE: METHODOLOGY

Data

Eleven consecutive years of arson data (January 2005 – December 2015) were drawn from preliminary incident reports from the Chicago Police Department's Citizen and Law Enforcement Analysis and Reporting (CLEAR) system. These reports are made publically available through the Chicago Data Portal. These data were selected because they include information indicative of spatiotemporal interaction and location which can be merged with demographic data. Demographic data were drawn from the 2010 American Community Survey 5-Year Estimates (2010-2014) that are made publically available through the United States Census Bureau. Block groups were chosen as the unit of analysis due to the documented modifiable areal unit problem associated with studying arson at higher levels of analysis (Gerell, 2016).

Dependent Variable

The dependent variable for the current study is arson by subtype. The CLEAR system reports six categorical types of arson incidents: aggravated, attempted, by explosion, by fire, possession of chemical/dry-ice device, and possession of explosive/incendiary device. For the purpose of this study, these subtypes are recoded into the following dummy variables: 'AGGRAVATED' where 0= non-aggravated and 1=aggravated, 'ATTEMPTED' where 0=non-attempted and 1=attempted, 'FIRE' where 0=non-fire, and 1=fire, 'EXPLOSIVE' where 0=non-explosive and 1=explosive, and 'POSSESSION' where 0=not possession of chemical/dry-ice

device or explosive/incendiary device and 1=possession of chemical/dry-ice device or explosive/incendiary device. Results are discussed by the level of aggravation and by subtype.

Definitions

Per the Illinois Criminal Statutes, non-aggravated arson is defined as the nonconsensual burning of property or the burning of property with the intent to defraud an insurer (720 ILCS 5/20, 2012). Aggravated arson is defined as the nonconsensual burning of property or the burning of property with the intent to defraud an insurer whereby the arsonist knows or reasonably knows that one or more persons are inhabiting the building. If any person suffers from great bodily harm, disability, or disfigurement, or if a law enforcement, fire department, or correctional authority is injured acting in the line of duty, the arson is also considered to be aggravated (720 ILCS 5/20-1.1). Given the nature of these offenses, non-aggravated arson can be seen as arson without personally knowing the victim and aggravated arson can be seen as arson where the victims or inhabiting persons are known or reasonably known. For the purposes of this study, non-aggravated arson is operationalized as attempted arson, arson by fire, arson by explosives, and possession of explosives or dry-ice devices.

Independent Variables

The first independent variable for the current study is social disorganization. To determine a block group's level of social disorganization, an index comprised of 6 different items derived from the 2010 American Community Survey 5-Year Estimates was created. These measures include family disruption, population density, poverty, residential instability, educational attainment, and unemployment. Family disruption is measured using the number of children under 18 not living with both parents. Population density is calculated as the number of

households divided by the area of each block group. Block groups which are bodies of water are not included in this measure. Poverty is measured using the percent of households with income below the federal poverty level. Educational attainment is measured using the percent of individuals over the age of 25 with less than a high school education. Residential instability is calculated using the number of rental units within a block group divided by the total number of households. Lastly, unemployment is calculated using the percent of employed individuals in the civilian workforce who are age 16 and older. The variables are aggregated into a total measure of social disorganization ($\alpha = .739$). The resulting social disorganization index z-scores are classified into 5 categories using the Natural Breaks (Jenks)³ classification system in ArcGIS 10.4.1 – social organized ($Z = -6.12$ to -0.61), approaching social organization ($Z = -0.60$ to 2.83), neither organized nor disorganized ($Z = 2.84$ to 6.30), approaching social disorganization ($Z = 6.301$ to 10.12), and socially disorganized ($Z = 10.20$ to 37.16).

The second independent variable is racial heterogeneity. Racial heterogeneity is calculated using Blau's (1977) measure which ranges from 0 to 1. This range is calculated by taking one minus the squared proportions of the population in each racial and ethnic group. The following groups are included in race: non-Hispanic whites, non-Hispanic blacks, non-Hispanic Asians, non-Hispanic American Indian/Alaskan natives, non-Hispanic Hawaiian/other Pacific Islander, and non-Hispanic other racial groups. The ethnic group were individuals of Hispanic descent.

³ According to ESRI, Natural Breaks (Jenks) classification classes are based on natural groupings inherent in the data. Breaks are identified based on similar values and that maximize differences between classes (e.g., 1-3 would be 1, 4-6 would be 2, 13 would be 3, 27-29 would be 4). (Environmental Systems Research Institute, 2017).

The third and fourth independent variables for the current study is the distance between the center of each block group to the closest fire station and the distance between the center of each block group to the closest police station. This is used as a measure of capable guardianship where the closer the police or fire station is, the higher the level of capable guardianship.

The fifth independent variable for the current study is physical disorder. Physical disorder is measured using two separate measures: 311 Reports of Abandoned Cars and 311 Reports of Abandoned Buildings.

The sixth and seventh independent variables for the current study are the count of EL stations and bus stops in each block group. Block groups with higher counts of EL stations or bus stops have greater accessibility to each type of transportation thereby increasing the potential number of motivated offenders.

Research Questions and Hypotheses

The following study asks the following questions: 1) how does arson offending relate to social disorganization and physical disorder, 2) how does racial heterogeneity relate to arson offending, 3) does capable guardianship act as a mitigating factor for arson offending, and 4) how does access to public transportation affect arson incidence?

H1: Arson is expected to increase with increasing levels of social disorganization.

H2: Arson is expected to increase with increasing levels of racial heterogeneity.

H3: Arson is expected to decrease with increasing levels of capable guardianship.

H4: Arson is expected to change in block groups with more public transportation.

In reference to Hypothesis 4, it is theorized that public transportation may interact with arson in two ways: it will either increase victimization and offending by increasing the number of

motivated offenders or decrease victimization by reducing the number of suitable targets (e.g., reduced number of motor vehicles in an area in favor of public transportation).

Analytical Strategy

The current study implements spatially lagged negative binomial regression to test the relationship between arson offenses, social disorganization, physical disorder, racial heterogeneity, and public transportation. If a relationship exists, capable guardianship is introduced to test the mediation of the other independent variables on arson offending. Based on the dispersion of data, negative binomial regression was chosen over Poisson regression. Tests were ran in STATA and ArcGIS 10.4.1. Socially disorganized neighborhoods will be classified using a graduated color scheme according to their Social Disorganization Index score and mapped using Natural Breaks (Jenks) in ArcMap 10.4.1. Moran's I and Anselin's Local Moran's I (Local Indicators of Spatial Association) tests were completed to determine spatial clustering and the level of spatial autocorrelation.

Spatial Weighting of Data

Using GeoDA, spatially lagged arson variable was created from multiplying the count of arsons per block group by a Queen contiguity spatial weights matrix. Queen contiguity determines the spatial influence of neighboring block groups on each block group. The inclusion of spatially lagged crime has been used with count models in criminological literature on burglary (Nobles, Ward & Tillyer, 2010) and arson (Butry & Prestemon, 2005; Prestemon, Butry & Thomas, 2013). In regards to arson, this method has been used to increase forecast accuracy and statistical validity.

CHAPTER FOUR: RESULTS

As shown in Table 1, a disproportionate number of arsons occur within block groups with very high levels of social disorganization or block groups with high levels of social disorganization. Only 8.1% of block groups are considered to have very high levels of social disorganization, yet 15.4% of arsons occur in these areas. Block groups with high levels of social disorganization comprise 21.6% of block groups in Chicago and contain 35.6% of all arson offenses. Despite the majority of block groups being classified as having low or medium social disorganization (52.5%), these block groups contain just under half of all arson offenses in Chicago (43.1%). Only 5.9% of arsons occurred in block groups with very low levels of social disorganization.

Therefore, based solely on descriptive statistics, arson offenses tend to increase with the level of social disorganization. The spatial influence between these variables will be discussed later. The spatial distribution of social disorganization is shown in Figure 1. Block groups with very high levels of social disorganization are primarily clustering in the West Side and South Side of Chicago with a few dispersed throughout the Upper East Side. Block groups with very low levels of social disorganization are on the North Side and the Central East Side of Chicago.

According to Tobler's (1970) first law of geography, "everything is related to everything else, but near things are more related than distant things". Therefore, it is posited that arson offending is highly influenced by arson in surrounding block groups. To test for this influential relationship, Moran's I and Anselin's Local Moran's I (Local Indicators of Spatial Association) tests were completed. As indicated by the Moran's I value, there is statistically significant global

autocorrelation among all arsons ($I=0.442526$, $p < 0.00$). The spatial distribution of arson is shown in Figure 2. Specifically, high-high clusters are found in the West Side and South Side of Chicago indicating that arsons are frequent in these areas. Low-low clusters are found interspersed throughout Chicago; however, they are most prevalent on the East Side. O'Hare International Airport is designated as a low-low cluster. These low-low indicators suggest that arson is infrequent in these areas in relation to the surrounding area. The high-high clusters often overlap with block groups that have high and very high levels of social disorganization. Because the spatially lagged arson coefficient is statistically significant in both indicators of autocorrelation, a spatially lagged arson variable is included in the following negative binomial regressions to increase the explanatory power of the models.

Table 2 illustrates the results of the spatially lagged negative binomial regression for overall arson. Overall, social disorganization ($\beta = .05$, $OR = 1.05$), abandoned cars ($\beta = .00$, $OR = 1.00$), abandoned buildings ($\beta = .01$, $OR = 1.01$), and bus stops ($\beta = .03$, $OR = 1.03$) were found to be statistically significant and positively related to arson. The distance from police ($\beta = -.00$, $OR = 0.14$), and EL stations ($\beta = -.17$, $OR = 0.84$) were found to be statistically significant and negatively related to arson. The distance from fire stations was found to be statistically insignificant. The spatial influence is found to be positive and significant ($\beta = .18$, $OR = 1.19$).

Table 3 illustrates the results of the spatially lagged negative binomial regression for aggravated arsons. Overall, social disorganization ($\beta = .09$, $OR = 1.10$), racial heterogeneity ($\beta = .35$, $OR = 1.41$), abandoned buildings ($\beta = .01$, $OR = 1.01$), and bus stops ($\beta = .03$, $OR = 1.03$) were found to be statistically significant and positively related to arson. The distance from the closest fire station ($\beta = -.00$, $OR = 0.99$) was found to be statistically significant and negatively

related to arson. The distance from the closest police station and the number of abandoned cars were found to be statistically insignificant. The spatial influence is found to be positive and significant ($\beta = .10$, OR = 1.10).

Table 4 illustrates the results of the spatially lagged negative binomial regression for attempted arson. Overall, social disorganization ($\beta = .06$, OR = 1.05), racial heterogeneity ($\beta = .04$, OR = 1.04), abandoned cars ($\beta = .00$, OR = 1.00), abandoned buildings ($\beta = .01$, OR = 1.01), and bus stops ($\beta = .03$, OR = 1.03) were found to be statistically significant and positively related to arson. The distance from fire stations, the distances from police and EL Stations were found to be statistically insignificant. The spatial influence is found to be positive and significant ($\beta = .15$, OR = 1.16).

Table 5 illustrates the results of the spatially lagged negative binomial regression for arsons by fire. Overall, social disorganization ($\beta = .04$, OR = 1.41), abandoned cars ($\beta = .00$, OR = 1.01), abandoned buildings ($\beta = .01$, OR = 1.01), and bus stops ($\beta = .0323$, OR = 1.03) were found to be statistically significant and positively related to arson. The distance from police stations ($\beta = -.00$, OR = 0.99), racial heterogeneity ($\beta = -.11$, OR = 0.89), and distance from EL stations ($\beta = -.28$, OR = 0.75) were found to be statistically significant and negatively related to arson. The distance from fire stations was found to be statistically insignificant. The spatial influence is found to be positive and significant ($\beta = .21$, OR = 1.23).

Table 6 illustrates the results of the spatially lagged negative binomial regression for possession of explosives or chemical/dry-ice devices. Overall, abandoned buildings ($\beta = .01$, OR = 1.01) and bus stops ($\beta = .05$, OR = 1.05) were found to be statistically significant and positively related to arson. Social disorganization, racial heterogeneity, the distance from fire

stations, the distance from police stations, abandoned cars, and EL stations were all found to be statistically insignificant. The spatial influence is found to be positive and significant ($\beta = .10$, OR = 1.10).

Overall, these findings support prior arson literature regarding the association between social disorganization and arson with the exception of the relationship between racial heterogeneity and arson. Potential explanations for these findings will be discussed in the following chapter; however, it is important to note that when using a spatially autoregressive process (e.g., spatially lagged arson), a radically different spatial model may arise that does not match the underlying theoretical premise (Anselin, 2002, 2).

CHAPTER FIVE: DISCUSSION

Arson in the United States has remained widely understudied despite the financial burden associated with recovering from these fires. With the majority of arson research taking place prior to 1992 (and the subsequent standardization of fire investigation) and being completed outside of the United States, a vast gap has remained within criminological literature despite recent advances in practitioner knowledge (Grubb & Nobles, 2016). The goal of this study was to fill the gap in criminological literature by completing an exploratory study of arson offending in the United States which encompassed both social and structural correlates. Two predominate criminological theories, social disorganization and routine activities, were used to inform the social and structural correlates chosen for the present study. In the following section, findings will be discussed by the category of arson (aggravated and non-aggravated) and the subtype (aggravated, attempted, by fire, possession of chemical/dry-ice or explosive/incendiary device).

Findings from the current study expand social disorganization theory by modeling its relationship with multiple levels of disorganization and the subtypes of arson as well as investigating its interaction with racial heterogeneity. Over the past 30 years, the relationship between arson, race/ethnicity, and social disorganization has been strongly debated in arson research. Prior research (Gunther, 1991) has argued that arson incidence is strongly linked to economic measures, such as household income, rather than race. Other research (Pettitway, 1987) argues that race and ethnicity do not increase or decrease the rate of victimization or offending when structural measures, such as transitional housing, are included. Social disorganization is positively correlated with overall arson, aggravated arsons, attempted arsons, and arsons by fire.

Similar to prior research, when controlling for both social disorganization and racial heterogeneity, social disorganization remains significant and racial heterogeneity drops out of significance for overall arson. However, when arson is broken into each subtype, different trends emerge in terms of racial heterogeneity. Racial heterogeneity is significantly and positively correlated with aggravated arsons and attempted arsons and negatively correlated with arsons by fire (approaching significance). These findings can be explained through traditional criminology's theory of intra-racial victimization and social disorganization theory. In regard to non-aggravated subtypes of arson (which may include attempted arsons), intra-racial victimization and offending (e.g., black victim/black offender) are significantly more frequent than expected by chance alone, if offenders chose their victims on a random basis (Blau, 1977; Becker, 2007; O'Brien, 1998). Especially given that same race neighborhoods are more likely to have higher levels of social disorganization, concentrated disadvantage, and crime (Sampson, Morenoff & Raudenbush, 2005). In the instance of non-aggravated arson, these crimes are more likely to be committed by offenders who victimize individuals of the same race given that they occur in block groups with lower levels of racial heterogeneity. Racial heterogeneity has historically been linked to fear and mistrust (Suttle, 1968) which pushes residents into seclusion from the race/ethnicity of the majority thereby impeding communication and interaction (as cited in Sampson & Groves, 1989). Moreover, arson in these block groups is theorized to be financially motivated rather than intergroup conflict-oriented. However, in reference to aggravated arson, these intergroup conflicts may be the motivation behind the arson given that the residents presiding within the structure, building, or vehicle are known or reasonably known. This provides more evidence for the nuanced and crucial relationship between race, structural

context, and arson, which is crucial to understanding the decision-making process and motivations of arson offending.

According to routine activities theory, three elements must converge in order for a crime to occur: lack of a capable guardian, a motivated offender, and suitable targets. The present study addresses the role of capable guardianship in Chicago as it relates to arson offending and how public transportation increases the accessibility to and from an area for motivated offenders and reduces the number of suitable targets. While the responsibility of arson investigation is disputed and often divided between police and fire agencies, in terms of prevention, fire services have largely been the focus of fire mitigation in prior studies (Chandler et al., 1984; Pettitway, 1983; 1985; Southwick & Butler, 1985; Duncombe, 1999). In the current study, by including the guardianship associated with both police and fire agencies, routine activities theory is expanded and shows further evidence for the importance of fire service agencies in preventing and mitigating arson offending. The distance from police mitigates overall arson and arsons by fire; yet the distance from fire departments mitigates aggravated arsons and arsons by fire. Both types of guardianship are insignificant for possession of chemical/dry-ice and explosive/incendiary devices. Though explanations for the importance of fire services are unknown at this time, it may be associated with accessibility to fire prevention services and education. Additionally, the areas associated with lower levels of guardianship may have greater numbers of abandoned buildings which are positively correlated with arson.

When taking the urban transportation system of Chicago into consideration, it was theorized that more diverse populations use public transportation over personal vehicles thereby reducing the number of suitable targets. Because of the positive correlation between abandoned

cars and arson, this suggests that personal vehicles act as a suitable target. Additionally, it was theorized that public transportation may increase the number of motivated offenders by increasing the accessibility to and from a particular area. However, the findings on the relationship between two of the primary public transportation systems in Chicago (the EL and buses) and arson is particularly interesting. Overall, accessibility to the EL decreased the probability of an arson occurring whereas accessibility to bus stops increased the rates of arson. This suggests that unlike other Part 1 Offenses, such as robbery (Bernasco & Block, 2011), EL stations do not act as a criminogenic factor for arson by increasing victimization. Similar to Stucky and Smith (2014), bus stops did act as a criminogenic factor for arson by increasing victimization and/or offending. The relationship between bus stops and arson was not affected conditionally by social disorganization suggesting that it is a global criminogenic relationship rather than a localized relationship. However, when arson is broken into each subtype, a few differences emerge. First, the only type of transportation affecting aggravated arson, attempted arson, arsons by fire, and possession of explosive devices or chemical/dry-ice devices is bus stops. This suggests that arsons are occurring in areas that have more bus stops (e.g., increased accessibility to and from the area). Accessibility to EL stations reduces the risk of overall arson occurring; however, this may be because the EL operates within a small geographic space and therefore is globally negatively correlated for arsons across Chicago.

Overall, these findings increase our understanding of arson offending by examining the social and structural correlates which precipitate offending and victimization. In general, areas with higher levels of social disorganization and physical disorder are more likely to have increased levels of victimization. Areas with lower levels of racial heterogeneity are more likely

to have higher levels of victimization due to financial motivations. Areas with higher levels of racial heterogeneity are more likely to have higher levels of victimization due to intergroup conflicts. However, overall, racial diversity is insignificant in predicting overall arson offending, but it does provide insight into the motivations for arson offending. Police and fire departments both play a role in mitigating arson offending; however, it is only applicable for some subtypes of arson suggesting that it is the accessibility to these prevention and/or educational services (in the case of fire services) rather than the physical location of the fire or police department that mitigates arson offending. By including public transportation in this study, our understanding of how public transportation affects arson offending is increased. Specifically, how increased accessibility to buses increase the probability of an arson occurring. However, EL stations, which reduce overall arson, do not increase or decrease the probability of an arson occurring. Lastly, abandoned vehicles and buildings serve as suitable targets for arson offending – thereby increasing the likelihood of arsons occurring in areas that have more abandoned buildings and vehicles.

Future Directions

The results from this study suggest the need for replication and extension of research on arson, especially in regard to social disorganization theory and racial heterogeneity. For example, as evidenced by Grubb and Nobles' (2016) work on near repeats of arson, arson and its near repeats occur within smaller timeframes (4-day and 7-day temporal bands). Therefore, there may be benefits of examining structural correlates within the same timeframe (e.g., 311-Reports that were called in the week before and prior to the date of a given arson incident) to model the decision-making process chosen by the offender. Additionally, it may be advantageous to include

other structural characteristics, such as land use, in future studies. The adoption of newer techniques, such as risk terrain modeling, may help identify and quantify nuanced structural and institutional factors across a landscape rather than a particular block group (Caplan, Kennedy, and Miller, 2011).

Overall, the fields of criminology and fire investigation would benefit from greater empirical research on arson characteristics and its causes. Evidence-based response and prevention strategies (of both law enforcement agencies and fire departments) could greatly benefit from studies on victimization and offending. Although arson is quite complex, the availability of new spatial and temporal analytical techniques to understand its nuances are plentiful and may help reduce its impact on society and the economy.

Limitations

This study has several limitations. First, the decision was made to include the distance to the fire stations as a measure of parochial control. The logic behind this measure is two-part: 1) Firefighters are often the first to respond on-scene before the fire is reported to law enforcement, and 2) In the State of Illinois, the responsibility of arson investigation is given to both fire departments and law enforcement agencies. Second, this is the first time that the racial heterogeneity measure used in this study has been applied to arson research. Therefore, the use of this measure may be the reason why the findings are inconsistent with prior arson research. Third, this study uses preliminary reports of arson prior to a full investigation taking place. Thus, this study may include fires which were later determined to be accidental or due to a mechanical or electrical failure. Fourth, this study did not differentiate between motor vehicular arson and non-motor vehicular arson. Therefore, there may be differences between structural and vehicle

arsons. Fifth, an index of social disorganization was used rather than measuring each component separately. By combining these components, the impact of specific components, such as poverty or residential instability, was lost. This may have resulted in the overall index becoming insignificant despite one or more of the components being statistically significant. Lastly, this study only examines arsons which took place in Chicago, a major urban city with an advanced public transportation system and historically high crime rates. As a result, these findings may not be generalizable to all cities or countries.

APPENDIX A: FIGURES

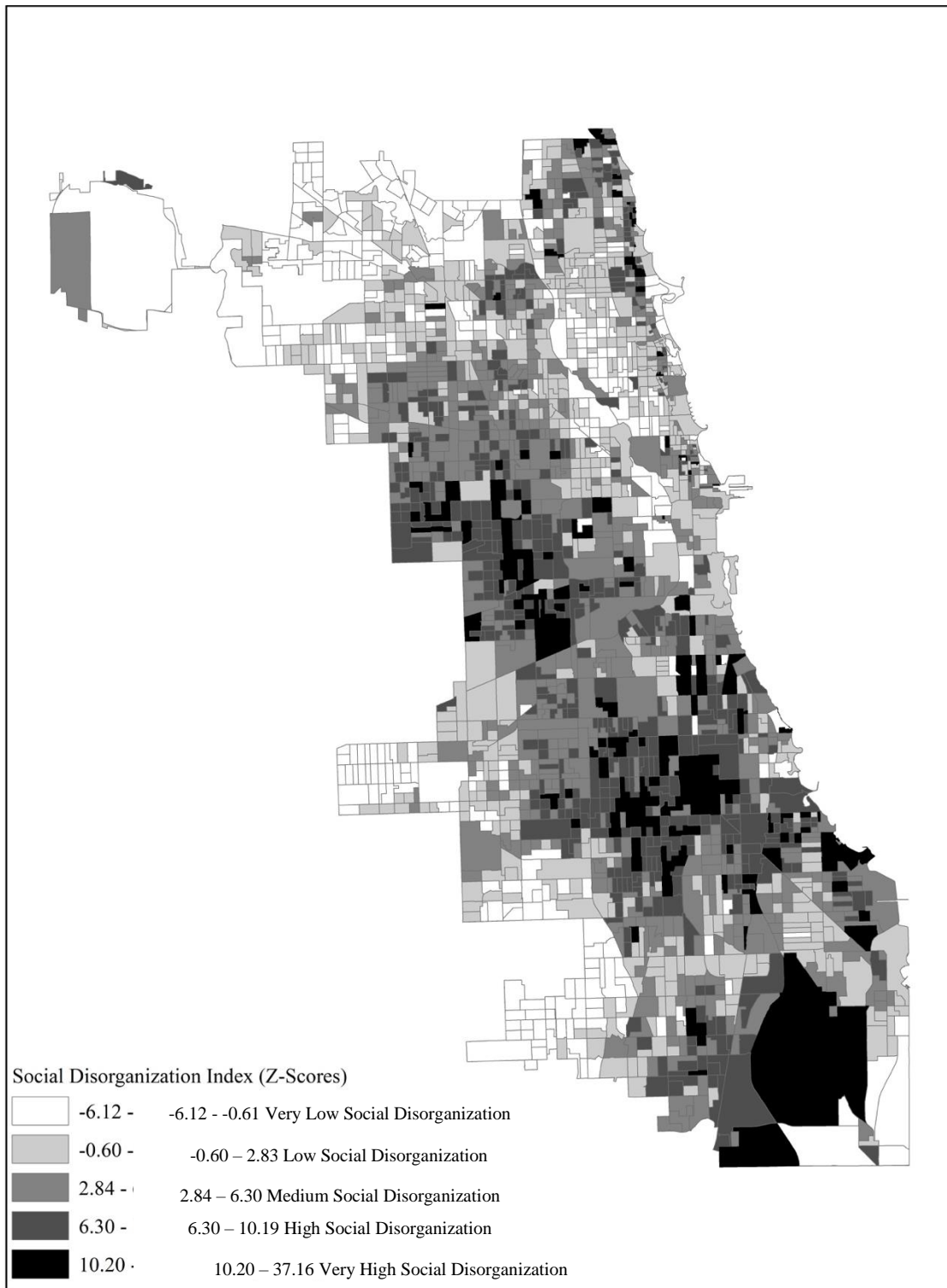


Figure 1. Social Disorganization Index (by Block Group) – Chicago, Illinois

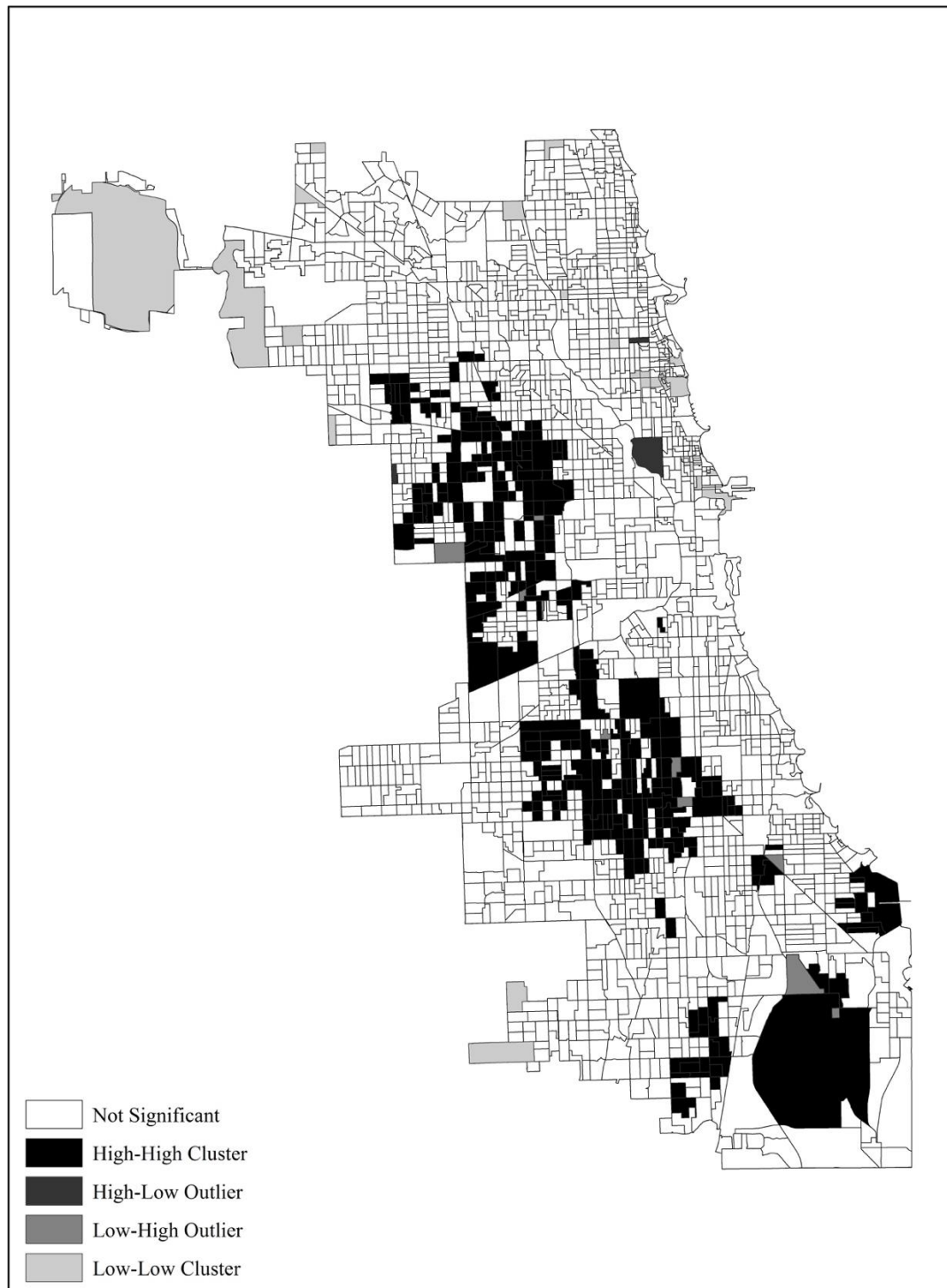


Figure 2. Local Indicators of Spatial Association – Total Arson in Chicago, Illinois (January 2005 – December 2015)

APPENDIX B: TABLES

Table 1. Descriptive Characteristics of Data

	Valid Incident Count	Percentage
Social Disorganization Index (by Block Groups)	2332	
Very Low Social Disorganization	415	17.8%
Low Social Disorganization	614	26.3%
Medium Social Disorganization	610	26.2%
High Social Disorganization	504	21.6%
Very High Social Disorganization	189	8.1%
Arsons by Social Disorganization Index	4151	
Very Low Social Disorganization	243	5.9%
Low Social Disorganization	614	14.8%
Medium Social Disorganization	1175	28.3%
High Social Disorganization	1478	35.6%
Very High Social Disorganization	641	15.4%

Table 2. Negative Binomial Regression – Total Arson

Variable	Coefficient (S.E.)
Social Disorganization Index	0.05 (.00)****
Racial Heterogeneity	-0.05 (.05)
Abandoned Cars	0.00 (.00)****
Abandoned Buildings	0.01 (.00)****
Distance from Police	-0.00 (.00)**
Distance from Fire	0.00 (.00)
EL Stations	-0.17 (.06)***
Bus Stations	0.03 (.00)****
Spatially Lagged Arson	0.18 (.01)****
R-Squared (Explained Variance)	0.15 (15%)
**** denotes significance at the $p < 0.001$ level	
*** denotes significance at the $p < 0.01$ level	
** denotes significance at the $p < 0.05$ level	
* denotes significance at the $p < 0.1$ level	

Table 3. Negative Binomial Regression – Aggravated Arson

Variable	Coefficient (S.E.)
Social Disorganization Index	0.09 (.00)****
Racial Heterogeneity	0.35 (.14)**
Abandoned Cars	0.00 (.00)
Abandoned Buildings	0.01 (.00)****
Distance from Police	-0.00 (.00)
Distance from Fire	-0.00 (.00)**
EL Stations	0.00 (.12)
Bus Stations	0.03 (.00)****
Spatially Lagged Arson	0.10 (.01)****
R-Squared (Explained Variance)	.13 (13%)
**** denotes significance at the $p < 0.001$ level	
*** denotes significance at the $p < 0.01$ level	
** denotes significance at the $p < 0.05$ level	
* denotes significance at the $p < 0.1$ level	

Table 4. Negative Binomial Regression – Attempted Arson

Variable	Coefficient (S.E.)
Social Disorganization Index	0.06 (.01)****
Racial Heterogeneity	0.04 (.07)****
Abandoned Cars	0.00 (.00)****
Abandoned Buildings	0.01 (.00)****
Distance from Police	-0.00 (.00)
Distance from Fire	0.00 (.00)
EL Stations	-0.05 (.11)
Bus Stations	0.03 (.00)****
Spatially Lagged Arson	0.15 (.01)****
R-Squared (Explained Variance)	.12 (12%)
**** denotes significance at the $p < 0.001$ level	
*** denotes significance at the $p < 0.01$ level	
** denotes significance at the $p < 0.05$ level	
* denotes significance at the $p < 0.1$ level	

Table 5. Negative Binomial Regression – Arson by Fire

Variable	Coefficient (S.E.)
Social Disorganization Index	0.04 (.00)****
Racial Heterogeneity	-0.11 (.06)*
Abandoned Cars	0.00 (.00)****
Abandoned Buildings	0.01 (.00)****
Distance from Police	-0.00 (.00)*
Distance from Fire	-0.00 (.00)
EL Stations	-0.28 (.08)***
Bus Stations	0.03 (.00)****
Spatially Lagged Arson	0.21 (.01)****
R-Squared (Explained Variance)	.13 (13%)
**** denotes significance at the $p < 0.001$ level	
*** denotes significance at the $p < 0.01$ level	
** denotes significance at the $p < 0.05$ level	
* denotes significance at the $p < 0.1$ level	

Table 6. Negative Binomial Regression – Possession of Explosive or Chemical/Dry-Ice Device

Variable	Coefficient (S.E.)
Social Disorganization Index	0.00 (.03)
Racial Heterogeneity	-0.19 (.12)
Abandoned Cars	-0.00 (.00)
Abandoned Buildings	0.01 (.00)***
Distance from Police	0.00 (.00)
Distance from Fire	0.00 (.00)
EL Stations	-0.00 (.27)
Bus Stations	0.05 (.01)***
Spatially Lagged Arson	0.10 (.06)*
R-Squared (Explained Variance)	.04 (4%)
**** denotes significance at the $p < 0.001$ level	
*** denotes significance at the $p < 0.01$ level	
** denotes significance at the $p < 0.05$ level	
* denotes significance at the $p < 0.1$ level	

Table 7. Summary of Regression Tables

	Total	Aggravated	Attempted	By Fire	Possession
Variables					
Social Disorganization Index	+****	+****	+****	+****	
Racial Heterogeneity		+**	+****	-*	
Abandoned Cars	+****		+****	+****	
Abandoned Buildings	+****	+****	+****	+****	+***
Distance from Police	-**			-*	
Distance from Fire		-**		-*	
EL Stations	-***				
Bus Stations	+****	+****	+****	+****	+***
Spatially Lagged Arson	+****	+****	+****	+****	+
**** denotes significance at the $p < 0.001$ level			+ denotes a positive relationship		
*** denotes significance at the $p < 0.01$ level			- denotes a negative relationship		
** denotes significance at the $p < 0.05$ level					
* denotes significance at the $p < 0.1$ level					

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